enthusiasm and foresight of its curator, and the cost of its production, which must have been heavy, and which its council have so liberally borne. Inseparable from the great collections it elucidates, this book should attract workers to them. It furnishes the basis from which all future research on the morphology of the mammalian cerebrum that shall be exact must take its start.

LIGHT FOR STUDENTS.

Light for Students. By Edwin Edser, A.R.C.Sc., &c. Pp. viii + 579. (London: Macmillan and Co., Ltd., 1902.) Price 6*s*.

THIS book is intended to meet the wants of the same class of students as the author's "Heat for Advanced Students," published three years ago. It gives a comprehensive account of the phenomena and laws of geometrical and physical optics, with a number of simple, illustrative experiments and examination questions. Special pains have been taken throughout, as in the author's "Heat," to make all the explanations as simple as possible, so that the private student, who has not the advantage of a teacher's assistance in explaining his difficulties, should find the book particularly helpful. Advanced mathematical methods have been scrupulously avoided, and the calculus is rigidly excluded. This necessarily limits the scope of the work, but the author has found it possible to give a very good general idea of the more difficult parts of the subject and of comparatively advanced theories, such as Sellmeier's theory of dispersion, without making any extravagant demands on the mathematical knowledge of the student.

The first ten chapters are devoted to geometrical optics, the last ten to the development of the wave theory of light. A brief summary is given of the properties of thick lenses, as introducing an account of the eye and of vision through lenses and spectacles. In the chapter on optical instruments, the construction of eye-pieces is dealt with at unusual length, but on the other hand, the account of telescopes is somewhat scanty. Little or nothing is said about the conditions affecting the brightness of the image or the extent of the field of view. The ray diagrams are drawn, following the prevailing custom, without indicating the correct position of the eye. The diagram of Galileo's telescope shows a pencil of rays full and centrical on the object-glass, and small and excentrical on the eye-lens. This is the common practice in text-books, but it does not correctly represent the conditions of vision through this instrument.

The following experiment is given as a proof that the spherical aberration of the eye is over-corrected:—

"Expt. 35.—Close one eye, and place the other at a distance of less than ten inches from a printed page, so that the type cannot be clearly seen. Then place a pinhole immediately in front of the pupil. The printing will become clearly visible, although rendered fainter owing to the loss of light."

Simple experiments of this kind are very helpful to the student, but in this particular instance the conclusion is hardly justifiable. The pinhole would also make the print clearer if held near the margin of the pupil or if the print were beyond the distance of distinct vision of a short-sighted eye. The experiment would be more appropriate as an illustration of increased depth of focus produced by stopping down a lens. An adequate test of the spherical aberration of the eye is not quite so simple.

The wave theory of light is introduced by a chapter on vibrations and waves in general, including an elementary account of the propagation of transverse waves in an elastic solid. This is followed by a general explanation of the rectilinear propagation of light, and of the reflection and refraction of waves. The chapter on the spectrum contains many illustrations from astronomy, such as the proof of the nature of Saturn's rings derived from the Doppler effect. But no account is given of theories of colour vision or of experimental methods of investigation. The chapters on interference, diffraction and polarisation contain photographic illustrations by Mr. W. B. Croft and others of fundamental phenomena. Some account is also given of recent instruments and experiments, such as the echelon grating and Rubens's experiments on infra-red rays of great wave-length. Limits of space have prevented the author from giving an account of the electromagnetic theory of light. The advisability of this would also have been questionable on other grounds. The book, considering its size, already contains an unusually large amount of information, and more could not reasonably be expected by the class of student for whom it is written.

H. L. C.

OUR BOOK SHELF.

Mr. Balfour's Apologetics Critically Examined. Pp. vi + 232. (London: Watts and Co., 1902.) Price 3*s*. 6*d*.

THIS book, issued anonymously by the Rationalist Press Association, is explicitly directed against Mr. Balfour's defence of Christianity (p. 10). To those who read with an animus against this "decaying creed," the author's vigour and lavish use of epithets may appear conclusive reasoning. To the impartial, it will scarcely appear to be criticism at all. Mr. Balfour's method in the "Foundations of Belief" was to advance from the more general philosophic position to the problem of "Provisional Unification." However much his critic believed that Mr. Balfour's theism was based on "emotion and sentiment" (p. 222), or that it could be explained by a review of his pedigree (p. 224), he had no right to rely too much on this application of the historical method.

At least, one expects to find that the "frontal attack" which the author prefers to Mr. Balfour's "sap and mine" (p. 222) shall be directed against the real stronghold. Yet, so far as this book goes, the author leaves untouched the questions, Has experience any elements which cannot be treated as we treat knowledge of "things"? If so, do these elements constitute data from which we may infer that "the whole circuit of belief" has wider foundations than "science" as such requires? And lastly, if the foundations are thus widened, do they admit Theism or Christianity as a form of it? It is easy to call the Incarnation a manifest absurdity; what is

wanted in a criticism of Mr. Balfour is some recognition of the philosophic position which led "a man of Mr. Balfour's intellectual power and high social standing" into a position which our author thinks "in many respects absurd and in all respects untenable" (p. 221). What is the author's philosophy? He thinks "all knowledge is science" and "science is all knowledge" can be interchanged; no explanation or defence is given; he considers sense-perception "the sole foundation of knowledge" (p. 149), and elsewhere asks whether Mr. Balfour has any channels of knowledge other than the senses and the intellect—an addition not without significance. Science (p. 26) is based on the evidence of the senses; theology is vitiated by having no such immediate contact with the evidence of the senses; yet "science is the only reasonable foundation on which Mr. Balfour's theology could be built" (p. 25).

The author considers Mr. Balfour has "uprooted the fabric of science" (p. 26). The careful reader will remember that the passage from which the author quotes the words "habitually mendacious" (p. 23) occurs in "Foundations of Belief," part ii., chap. 1, § iv., and that there Mr. Balfour does not argue that "we are unable to prove the reliability of the senses or the existence of an external world" (p. 147), but only that the "immediate experience" upon which so much has been said is really mediate, and that science now refutes the philosophy which shelters its bad psychology under so good a name. This may be enough to save the unphilosophic reader from thinking that the author writes from an assured position. His discussion of the cardinal questions of "cause," "uniformity" and the like is inadequate; he is equally unfortunate in labouring to disprove (p. 132) a theory which in Mr. Balfour appears as an example of individual bias and is put into the mouth of "the third of our supposed jurymen" ("Foundations of Belief," ed. 1895, p. 314); while the chapter on "Ethics," in itself good, is equally irrelevant; to say that by "religious truths Mr. Balfour means ethical truths" is a gratuitous assumption. The book has far too few references, always inverted and sometimes inaccurate. The index is designed to be amusing; occasionally it is useful.

G. S. B.

La Vie des Animaux illustrée. By E. Perrier. Pp. xxviii+124. (Paris: Baillière et Fils, n.d.) Price Fr. 6.

IF we may judge by the first number, of which we have received a copy from the publishers, this new natural history bids fair to eclipse all publications of a similar nature by the number and beauty of its coloured plates. The name of the Director of the Paris Museum of Natural History is a sufficient guarantee that the text will be all that it should be; while the fact that the coloured plates are from sketches by Herr W. Kuhnert testifies that from both the artistic and the realistic points of view they will have few rivals. The authorship of the sections devoted to mammals and birds has been entrusted to Dr. H. Menegaux, who, in the part before us, treats in a popular, but at the same time exact, manner of the apes, monkeys and lemurs. No less than eighty coloured plates, as we learn from the title-page, are to be assigned to the illustration of the mammals, and of these, nine appear in the present part of 124 pages. All are first-class examples of three-colour printing, and we believe that such a wealth of illustration has never before appeared in a popular natural history. In addition to the coloured plates, the part before us contains a large number of text-figures, all reproduced from pen-and-ink sketches by Herr Kuhnert. As the publishers state in their prospectus, such illustrations are far superior, both from the artistic and the zoological aspects, to reproductions from photographs drawn from miscellaneous sources, which are generally out of harmony with one another and too often fail to display the characteristic features of the animals they represent. We notice that the author refuses to accept modern innovations in nomenclature, retaining, for instance, the familiar Mycetes (in place of Alouatta) for the howling monkeys. One of the main arguments used by the advocates of such changes was that it would conduce to uniformity; but experience seems to suggest that it will have exactly the contrary effect, and if so, where is the justification for such changes?

The work, so far as we can at present judge, is worthy of all commendation, and ought to obtain a large circulation on the other side of the Channel. The price is six francs per part. R. L.

Das biomechanische (neo-vitalistische) Denken in der Medizin und in der Biologie. By Prof. Moriz Benedikt. (Jena: Gustav Fischer, 1903, published 1902.) Pp 57. Price 1.50 marks.

PROF. BENEDIKT protests against the distinction often drawn between mental and natural sciences. Mental science should have an experimental basis; natural science cannot complete itself apart from philosophical psychology. Physical and chemical formulæ do indeed apply to vital phenomena, but they are inadequate for a complete interpretation; "Biomechanik" requires to be supplemented by a "Seelen-mechanik." Every "manifestation" (M) or expression of vital activity (Lebensäusserung) is a function of the inherited "nature" or heritage (N); of the "second nature" or external "nurture" of appropriate environment, psychical as well as physical (N'); of less essential developmental or environmental influences (E); and of incidental or occasional interruptions (O). Thus we reach the vital equation

$$M = f(\pm N, \pm N', \pm E, \pm O).$$

This does not strike us as particularly novel, but Prof. Benedikt works it out in an interesting essay—an apologia for neo-vitalism—in which he discusses cell-life, action at a distance among cells, nervous activities, circulation-phenomena, growth and reproduction. The author hopes that "der feinfühlige Leser" will appreciate his effort at simplicity; but we must condemn ourselves in confessing that we have found his essay exceedingly difficult. It suggests a half-revealed secret, but what the secret is we have been unable to discover. J. A. T.

Monographie des Mutillides d'Europe et d'Algérie. Par Ernest André, Membre de la Société entomologique de France. Pp. 478. Avec 15 planches coloriées et noire. Forme le Tome viii. du "Spécies des Hymenoptères." (Paris: Hermann, 1903.)

IT is only a short time since we had the pleasure of noticing the first half of vol. vii. of this important work, which contained the commencement of the Cynipidæ, and already vol. viii. lies before us, containing the Mutillidæ, edited by Ernest André, the brother of Edmond André, the founder of the work, to whose memory this volume is dedicated.

The Mutillidæ are an interesting family of insects, which were thus named by Linnæus because the females of the commonest species are apterous. They were formerly called solitary ants and were placed near the Formicidæ, but are now more properly regarded as forming a family of the Fossores, or burrowing wasps. There are only three species in Britain, which are not very common; but in warmer countries, and even in the Mediterranean region, they are much more numerous. About 120 species are discussed in the work before us, besides very numerous varieties. The total number of described species is estimated at 1600. The family is divided into four tribes, or subfamilies, Fedschenkiinæ, Apterogyninæ, Methocinæ and Mutillinæ but only